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TOP-ICING CANTALOUPS

By

W. T. Pentzer, Senior Physiologist
W. R. Barger, Associate Physiologist
D. H. Dewey, Assistant Physiologist
J. S. Wiant, Senior Pathologist
G. B. Ramsey, Senior Pathologist

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TOP-ICING CANTALOUPS

Top-icing was tried as a method of precooling full-slip vine-ripened cantaloups in 1944 and since then it has become a general practice in California and Arizona. Originally about 10,000 pounds of ice was used per carload irrespective of the temperature of the melons. During the past two seasons an attempt has been made by some shippers to regulate the amount of top-ice applied by the temperature of the melons. This was prompted by complaints at the markets that melons were too wet and that top-ice still remained on the load upon arrival. Because of the general interest in the subject, shipping tests were made in 1947 to evaluate a schedule of top-icing based on heat loads as represented by melons of different temperatures when loaded.

Methods

The schedule prepared for top-icing took into account the removal of field heat from a carload of cantaloups (312 crates) and the heat of respiration for the first two days in transit (time until cooled). The weight of melons was considered to be 80 pounds per crate with a specific heat of 0.92 and wood to be 5 pounds per crate, specific heat 0.327. To lower the temperature of 312 crates 1° F. would require the removal of 22,963 Btu. from the melons and 510 Btu. from the crates for a total of 23,473 Btu. which would be equivalent to the meltage of 163 pounds of ice.

The amount of vital heat liberated was obtained from respifation data reported in U.S.D.A. Technical Bulletin No. 730, page 27. The heat calculations and icing schedule for melons of different temperatures is given below in table 1.

Table 1. Amount of heat to be removed in cooling 312 crates of cantaloups at temperatures of 95° to 65° F. to a final temperature of 35° F.

Temp. of load	Removal of field heat to 35° F.		Vital heat in 48 hours		Total heat	Ice equivalent	
°F.	°F.	Btu.	°F. Av.	Btu.	Btu.	Lbs.	300-lb.blocks
95	60	1,408,380	60	296,000	1,704,380	11,800	39
90	55	1,291,020	60	296,000	1,587,020	11,000	37
85	50	1,173,650	55	199,490	1,373,140	9,500	32
80	45	1,056,290	50	102,960	1,159,250	8,000	27
75	40	938,92[illegible]	50	102,960	1,041,880	7,200	24
70	35	821,550	45	88,550	910,100	6,300	21
65	30	704,190	45	88,550	792,740	5,500	18

Beginning in May, eighteen test cars of melons were shipped to eastern markets with quantities of top-ice ranging up to several thousand pounds above or below the amount required (table 2) according to the schedule in table 1.

Table 2. List of test cars shipped in study of top-icing.

Car	Number	Date	Shipper	Destination	Loading finished	Av. melon Temp.	Top-iced Time	Top-iced Amount 300 lb. blocks	Excess or deficit 1/ 300 lb. blocks
	PFE					°F.			
1	45709	5/28	Am. Fr. Grs.	Chgo.	3:00 PM	86	3:10P	25	-7
2	45162	5/28	Do.	N. Y.	2:10 PM	85	2:20P	25	-7
3	94103	5/28	Arena	N. Y.	10:30 AM	71	10:45A	20	-2
4	49372 2/	5/28	Gerrard	Chgo.	10:00 AM	67	2:30P	34	+15
5	34835	5/28	Do.	N. Y.	1:30 PM	80	4:00P	34	+7
6	40266	5/28	Murphy	Chgo.	5:30 PM	91	6:45P	32	-5
7	94456	5/28	Jack Bros.	N. Y.	1:10 PM	85	5:00P	32	0
8	91849	5/28	West. Fr. Grs.	N. Y.	10:30 AM	73	11:15A	34	+12
9	60448	5/29	Arena	Chgo.	10:35 AM	75	11:00A	20	-4
10	61648	5/29	Jack Bros.	Chgo.	9:45 AM	73	11:30A	28	+6
11	75057	5/29	Am. Fr. Grs.	N. Y.	2:40 PM	91	3:30P	35	-3
12	50470	5/29	Do.	Chgo.	3:45 PM	90	4:45P	30	-7
13	42794	5/30	Arena	N. Y.	11:15 AM	68	11:40A	28	+8
14	60512	5/30	Do.	N. Y.	2:40 PM	87	2:50P	35	+1
15	64786	5/30	Am. Fr. Grs.	N. Y.	2:30 PM	91	2:50P	35	-2
16	32339	5/30	West. Fr. Grs.	N. Y.	1:30 PM	78	1:50P	40	+14
17	96804	5/30	Gerrard	N. Y.	12:00 M	73	3:30P	34	+12
18	43418	5/30	Jack Bros.	N. Y.	9:30 AM	70	10:30A	28	+7
E	62586	6/7	Gerrard	N. Y.	11:00 AM	78	1:00P	15	-11
F	64299	6/7	Hilvert	N. Y.	11:00 AM	81	11:35A	28	0
G	44886	6/7	Arena	N. Y.	2:10 PM	86	2:25P	35	+2
H	63115	6/7	Murphy	Chgo.	2:00 PM	74	2:05P	12	-11

1/ Based on table 1 showing ice needed for removal of field and vital heat.
2/ WFEX.

Recording thermometers were placed in top layer crates of the doorway, quarterlength, and bunker stacks to obtain continuous temperature records. Cooling rates were followed during the first few days in transit by means of electric thermometers inserted into melons in bottom, middle and top layers. These were read and the cars were inspected at Yuma and Tucson, Arizona, approximately 24 and 36 hours, respectively, after top-icing. Photographs were taken in some cars to show the amount of ice left on the load at these places.

Two test crates were placed in the top layer, quarterlength, of each car. One of these consisted of ripe melons classed as firm-ripe, or "choice", which were typical of the melons commonly shipped in top-iced cars. The other crate was made up of hard-ripe melons on the "fancy" side, mostly full-slip but hard and lacking yellow color. These represented melons commonly given less refrigeration by nominal pre-cooling than is afforded by top-icing. Their behavior under various amounts of top-ice was of particular interest in view of the results of Morris' 1/ work which indicated that 8 or 16 days' exposure to ice caused fancy and hard-ripe melons to develop large sunken surface areas, an increase in decay, and failure to color properly when removed to room temperature. The injury was more severe on the less mature fancy melons than on the hard ripes. Full ripe choice melons were not affected by 16 days' exposure to ice. Because of these results, which were with the mildew-resistant 45 variety, he cautioned against the use of ice in direct contact with the melons for longer than 8 days. The limit reported for Honey-dew and Crenshaw melons was four days.

In our experimental work the test crates of melons were recovered from the cars by co-workers in Chicago and New York and were held 2 or 3 days to determine the effect of top-icing and transit temperatures on their market life.

The series of 18 shipping tests were followed by a transportation test of 8 cars accompanied to New York, N. Y. Four of the accompanied cars were top-iced with different amounts of ice and one of these was mechanically precooled immediately following top-icing (car H, table 2). This test afforded a close comparison of temperatures throughout the load and a first-hand inspection of the meltage of top-ice in transit and the condition of the cantaloups upon unloading.

All of the cars, including those which were top-iced, received bunker ice prior to loading and throughout the transit period. The tentative schedule of top-icing was based on the removal of field heat and vital heat by top-ice alone. Since the bunker ice actually does part of this, our estimates are known to be high and on the safe side.

The average temperature of the load was estimated for top-icing by taking the temperature of at least ten melons while the car was being loaded. This was usually accomplished by selecting cull melons from the packing bins as they were packed.

1/ Morris, L. L. The use of ice on cantaloupes and other melons. Truck Crops Mimeo. No. 38. Davis, March, 1947.

Results

Chicago cars

The temperature records, top-ice inspections, and condition of the melons when shipped and upon arrival in the six Chicago cars are summarized in table 3. Car 4 was an example of heavy top-icing with 34 blocks of ice which was fifteen blocks in excess of what the initial temperature of the load (67° F.) called for. The inspection at Yuma showed much top-ice left with the load still covered. By the time the car reached Chicago on the seventh day, all ice was gone from the top of the load but some remained in the channels. Recording thermometer records indicated that most of the top-ice was gone by the fourth day in transit. No ill effects from heavy top-icing were noted. Two other warmer cars were shipped the same day, purposely top-iced lightly (cars 1 and 6). Most of the top-ice was gone by the time they reached Yuma, Arizona, (see fig. 1 for photographs of car 1), and melon temperatures in the top layer were 40° and 44° F., respectively, instead of 35° or 36° as in car 4, indicating less cooling than in the more heavily top-iced car. They arrived in good condition despite slightly higher transit temperatures.

The following day three cars were shipped that afforded another comparison of heavy and light top-icing (table 3). When inspected at Tucson (about 36 hours after top-icing), the loads in lightly top-iced cars 9 and 12 were almost bare, whereas car 10, top-iced with six blocks in excess of requirement had one-fourth of the load part covered with ice. Car 9, 75° F., top-iced with 20 blocks and four less than called for, was mostly bare at Tucson and it had no channel or top-ice left at Chicago. The other two cars had no top-ice left but some ice still remained in the channels. All three of the cars arrived in good condition and the melons were about equally dry in all loads.

The market behavior of greenish, hard-ripe, and choice melons shipped in these six cars was followed closely and there was no indication of impairment of ripening even in the melons of car 4 which was so heavily top-iced. The melons ripened with good quality and developed no abnormalities. As pointed out, these melons were probably covered with ice no longer than four days; thus they were not too cold long enough to manifest the symptoms described by Morris.

These test cars shipped to the Chicago market indicated that as far as the condition of the melons was concerned there was no advantage of heavy top-icing to a full 10,000 pounds, nor was there any detriment from it. Using approximately the amount indicated by melon temperatures appears to be a safe practice.

New York cars

In the first day's shipment, five cars were sent to New York containing as much as twelve blocks (3,600 pounds) of ice in excess of the temperature requirement and at the other extreme seven blocks (2,100 pounds) under the schedule (table 4). The heavily top-iced car (car 8) had somewhat lower melon temperatures than the companion cars; the load was two-thirds covered with ice at Tucson and still had a small quantity on arrival at New York, N. Y. In this car, many of the crates were wet when unloaded and this was true also of two other cars of this series, cars 5 and 7. They had been top-iced with 34 and 32 blocks of top-ice respectively. Photographs of the load in car 5 are shown in fig. 2. No harm was done the melons by the heavy top-icing. Some of the cars less heavily iced, such as cars 2 and 3, had crates and melons mostly dry upon arrival. These cars received 24 and 20 blocks of top-ice, respectively, and most of it was gone at Tucson. This was probably desirable from the standpoint of drying off the load. The somewhat higher transit temperatures associated with light top-icing (fig. 3) apparently were safe enough for the maturity and condition of the melons shipped. In cars 2 and 3, firm ripe or choice melons showed no decay on arrival and were good for two or three days on the market. Melons of this maturity shipped in heavily top-iced car 8 had a similar market life.

Another series of six test cars was shipped on May 30 to New York. All of these were fairly heavily top-iced. Transit temperatures for the most part were close to 40° F. or lower (table 5 and figure 4). The top layer crates were wet on arrival at New York and some top-ice remained in cars 16 and 17 which were given an excess of 14 and 12 blocks of ice, respectively. The loads in these cars were still about two-thirds covered at Tucson; also, there was probably more top-ice in the other four cars than was needed, judging from the amount remaining at Tucson (table 4). Although the commercial loads of cars 16, 17 and 18 showed no bad effects from heavy top-icing, test crates of greenish hard-ripe melons shipped in these cars failed to develop good flavor, color, and texture during a 3- to 4- day ripening period. This was probably a case of immaturity rather than low temperature injury, for other hard-ripe melons shipped in cars with similar temperatures developed very acceptable quality.

Heavily top-iced car 16 had lower top layer temperatures than companion cars 13 and 15 that were iced more closely to their requirements for removal of field heat (fig. 4).

The final test of four cars made on June 7 included a car lightly top-iced and then precooled for four hours with a mechanically refrigerated unit (car E, table 6). During the first 2 hours, no refrigeration was used and most of the top-ice was melted off during this period. The top layer of the load had a temperature of about 49° F. at the end of precooling, whereas top-iced, non-precooled companion cars F, G, and H had corresponding temperatures of 54°, 58°, and 58°, respectively, at midnight following top-icing (fig. 5). Further cooling of the pre-cooled car was slow in transit however, as compared with the cars top-iced in the usual manner (F and G). The latter had temperatures of 36° by the time they reached Tucson whereas the lightly top-iced precooled car was 41° and did not get much lower than this the rest of the trip. This car had salt added to the extent of 2 percent of the bunker capacity at Brawley, and an amount equal to 2 percent of the ice supplied at Yuma. This resulted in bottom layer temperatures close to freezing and a wider temperature spread between top and bottom layers than in the other top-iced cars which were not salted. The disadvantage of refrigerating a car in this manner appears to be the uncertainty of the amount of cooling which will be accomplished, whereas an adequately top-iced car is sure to reach a satisfactory temperature in transit.

Cars F and G were top-iced very nearly to schedule and they both had only a small amount of ice remaining at Tucson. The former was a fan car, shipped with fans on. Some ice was left on top of the load the fourth day after loading. It had very uniform cool temperatures, 35° to 38° F., for most of the trip. Standard car G, which was top-iced a little more heavily, had very similar temperatures. The melons in cars E, F, and G were in good condition when unloaded in New York, showing no decay or overripeness.

Car H was lightly top-iced with 12 blocks, eleven less than the schedule called for. This was done in an attempt to ripen the greenish-colored melons in transit but not much was accomplished in this direction since temperatures were soon too low, reaching 50° at Yuma and 44° at Tucson in the top layer. The average for the trip was about 46° whereas average temperatures of about 50° to 55° would have been needed to ripen the melons enough in ten days to have them ready for immediate marketing on arrival. (U. S. D. A. Tech. Bul. 730).

Precooling top-iced cars

Additional tests were made on the effect of forced-air circulation in top-iced cars on cooling rates (fig. 6). The following comparisons were made:

Car A. Top-iced with ten cakes of ice (3,000 pounds), cooled with mechanically refrigerated trackside units.
Car B. Top-iced with28 cakes of ice (8,400 pounds).
Car C. Precooled, not top-iced.
Car D. Top-iced with 28 cakes of ice, precooled with Preco fans.

The fastest precooling and the lowest temperatures were obtained by a combination of top-icing adequately (28 blocks) according to the temperature of the melons, followed by precooling with car fans. Next in order was top-icing alone. Top-ice was particularly effective in cooling middle and bottom layers whereas precooled, non-top-iced cars showed fastest cooling of top layers. The poorest job of all was obtained by top-icing lightly and melting it off with trackside precoolers, using no refrigeration part of the time. These results point to a practical application. If a car of ripe melons must be shipped a long distance, fast cooling would be desirable. This could be accomplished in fan cars by top-icing in the usual manner, and then precooling with car fans. By this method, the entire load can be cooled to 36° to 40° in 9 or 10 hours, whereas without forced air circulation, 24 to 36 hours would be required to obtain this temperature in a top-iced car.

Discussion of results

The idea of using enough top-ice to do the cooling job but not much in excess of this appears to be a good one, since it will permit the melons to dry off in transit and will avoid any danger of over-exposure to low temperatures. Since top-icing is intended to be a substitute for precooling, it should be done in a manner that will promote uniform cooling of all parts of the load. This calls for applying ice evenly, covering all crates, instead of piling it deep at the doorway or against side walls or bulkheads and leaving other crates practically bare.

Cars receiving an inadequate amount of top ice will be comparable to poorly precooled cars and may show decay and overripeness due to high transit temperatures. No such trouble was encountered in these tests but reasonable care was taken that lightly top-iced cars were not loaded with ripe melons. The transit temperature records indicated that dangerous temperatures might occur if a carload of warm, ripe melons was top-iced lightly in warm weather. No bruising or mechanical damage was observed from top-ice even when 40 blocks of ice were used, but the crates and melons were undesirably wet on arrival. As in previous studies, it was demonstrated that top-ice should be used for vine-ripened melons and not for half-slip greenish melons. The latter require warmer transit temperatures that can be obtained best by precooling them to about 55°. There was no need for salting the bunker ice in top-iced cars, in fact, it has caused too low temperatures and freezing damage in bottom layers near the bunker.

The cooling rate of melons in a car adequately top-iced is not as fast as might be imagined. It may take 20 to 24 hours to get the melons to 40° to 45° F. The big advantage of top-icing is that it is a sure way of getting the heat out of the melons. It has eliminated the uncertainty associated with commercial precooling practices. By combining the usual job of top-icing with air circulation within the car, cooling can be speeded up. The extra cost might be worthwhile for a car of ripe melons. The combination of light top-icing and precooling was not satisfactory for there was not enough refrigeration supplied to obtain the low temperatures in transit obtained by adequate top-icing.

Practical application

The tentative schedule for top-icing cantaloups shown in table 1 has been used by some shippers this past season with satisfactory results. In addition, a schedule closely similar to this was used independently by the Easwest Produce Company and good results have been reported on well over a thousand carloads iced in this manner. Schedules for top-icing based on melon temperatures were first suggested by Foote 2/ for Arizona conditions and were tried in 1946 and 1947 by Arizona shippers. There is, therefore, considerable commercial experience in top-icing according to a temperature schedule. The important point, regardless of the schedule used, is to practice good judgement in top-icing. Take enough melon temperatures to give an accurate average; if the melons are ripe and the weather is warm, stay on the safe side. No damage has been observed in these tests from too much top-ice but lack of enough could be serious. Cover the load evenly, taking care not to injure the melons, using a splash board to prevent this. It is important to check the temperature of the crushed ice occasionally and not use any that is colder than 29° to 30° F. This will avoid danger of freezing top layer melons.

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2/ Foote, J. M. The Packer, March 9, 1946, page 7.

Table 3. Comparison of cantaloup cars shipped to Chicago, Ill., under different amounts of top-ice.

Car	Transit period	Top-ice Blocks	Top-ice Excess or deficit	Average temp. when loaded °F.	Melon temp. in top layer Yuma °F.	Melon temp. in top layer Tucson °F.	Melon temp. in top layer Chicago °F.	Top-ice inspection	Melon and load inspections
4 WFEX 49372	5/28 to 6/4	34	+15	67	36	35	--	Yuma: Load still covered, 2-3 inches deep. Chicago: None, channel ice 6-8 inches deep B end, A end none.	Brawley: Med. to high color, full slip, fairly firm. Chicago: No objectionable wetness, melons, firm, good yellow ground color, no decay or serious bruising.
1 PFE	5/28 to 6/3	25	- 7	86	40	37	38	Yuma: Nearly bare. Chicago: None, channel ice 6-10 inches deep, irregular.	Brawley: Distinct yellowish under color, choice maturity. Chicago: Melons, crates dry except bottom layer, melons firm, most good yellow ground color, no decay or bruising.
6 PFE 40266	5/28 to 6/3	32	- 5	91	44	39	39	Tucson: Few patches left. Chicago: None left, channel ice irregular, 0 to 12 inches deep.	Brawley: Load hard ripe, full slip, firm on green side. Chicago: Mostly firm, good ground color, no decay or serious bruising,
10 PFE 61648	5/29 to 6/5	28	+ 6	73	--	38	38	Tucson: Spotty, about 1/4 of load covered. Chicago: No top-ice, channel ice, 0-12 inches deep.	Brawley: Major portion of load, 2 bot. layers full yellow, choice. Chicago: No bruising, decay; melons firm, good ground color.
12 PFE 50470	5/29 to 6/5	30	- 7	90	--	41	38	Tucson: Spotty, 3 in. deep between q. lengths and door. Chicago: No top-ice, channel ice irregular, 0-12 inches deep.	Brawley: Rather greenish hard ripe, except for two stacks. Chicago: Peculiar water soaked condition in some melons.
9 PFE 60448	5/29 to 6/5	20	- 4	75	--	41	40	Tucson: Nearly bare. Chicago: No top-ice or channel ice.	Brawley: Melons not as yellow as some. Chicago: Load shifted, some breakage, melons well colored, occasional soft, rubbery.

Table 4. Comparison of cantaloup cars shipped to New York under different amounts of top-ice. Shipments of May 28 and 29.

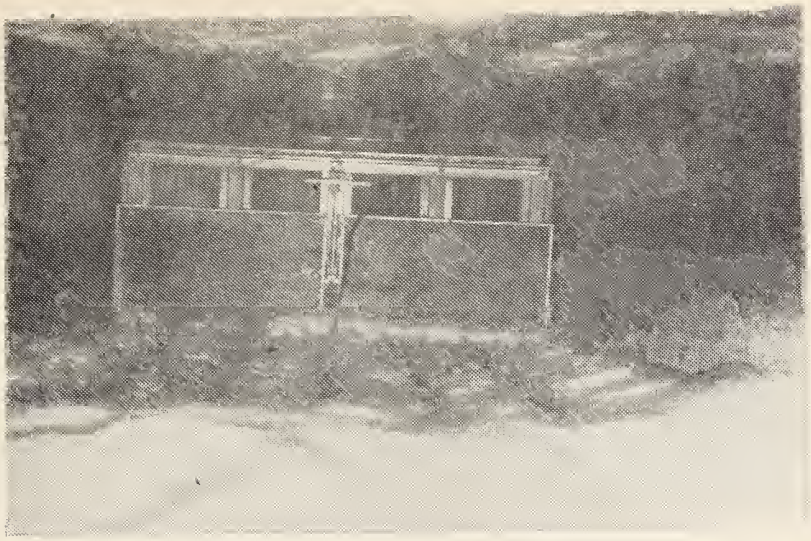
Car	Transit period	Top-ice: 300 lb. blocks	Top-ice: Excess or deficit	Average temp. when loaded	Melon temp. in top layer: Yuma	Melon temp. in top layer: Tucson	Melon temp. in top layer: New York N. Y.	Top-ice inspection	Melon and load inspections
				°F.	°F.	°F.	°F.		
8 PFE 91849	5/28 to 6/5	34	+ 12	73	38	34	37	Tucson: 2/3 of load still covered. New York: About 50 lbs. left on top, 600 lb. in channels 1 to 2 feet deep.	Brawley: Melons moderately yellow, fairly firm. New York: Many crates wet, no mold or decay, mostly yellow green, firm.
5 PFE 34835	5/28 to 6/5	34	+ 7	80	44	40	42	Yuma: Load still more than 1/2 covered, few inches deep. Tucson: About same. New York: About 15 lbs. left, 400 lbs. channel ice.	Brawley: Medium to high color, firm to fairly firm. New York: Most crates wet, melons predominantly yellow, practically no mold or decay.
7 PFE 94456	5/28 to 6/5	32	0	85	49	42	43	Tucson: Patches on low end, none on deck end of load. New York: No top-ice, about 35 lbs. channel ice.	Brawley: Excellent full shipping choice. New York: Most crates wet, melons mostly yellow green, no mold, decay.
3 PFE 94103	5/28 to 6/6	20	- 2	71	47	43	43	Tucson: Load bare. New York: No top-ice or channel ice, floor-racks dry.	Brawley: Not full firm ripe or choice, slightly greener. New York: Crates dry, melons mostly yellow, green, firm to fairly firm, 20% sl. mold, no decay.
2 PFE 45162	5/28 to 6/5	25	- 7	85	48.5	43	41	Tucson: Nearly bare. New York: No top-ice 200 lb. channel ice.	Brawley: Hardripe, slight yellowish undercolor. New York: Crates mostly dry on top, melons mostly greenish, some yellow grn., hard to firm.
11 PFE 75057	5/29 to 6/8	34	- 3	91	--	41.5	42	Tucson: About 1/3 covered. New York: Practically none left, 225 lbs. channel ice.	Brawley: Mature car of melons, firm ripe or choice.

Table 5. Comparison of cantaloup cars shipped to New York under different amounts of top-ice. Shipments of May 30, unloaded New York, June 8.

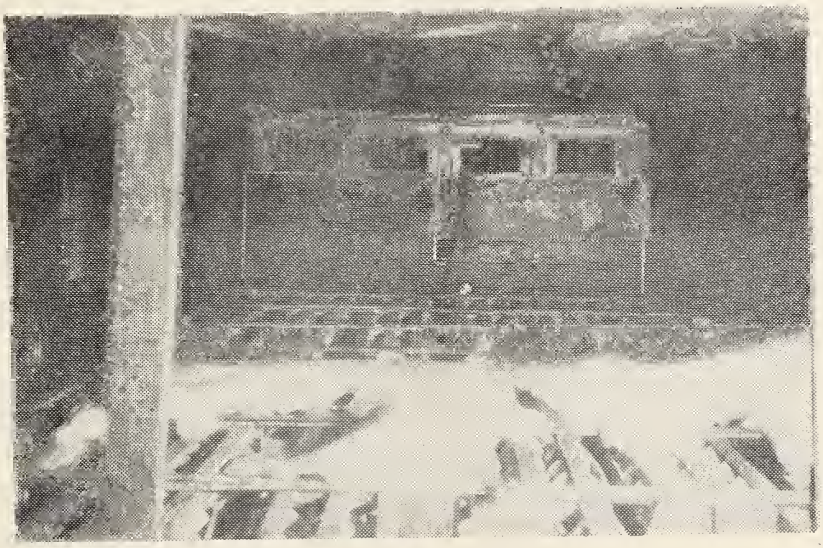
Car	Top-ice: 300 lbs. blocks	Top-ice: Excess or deficit 300 lb. blocks	Average temp. when loaded °F.	Melon temp. in top layer: Yuma °F.	Melon temp. in top layer: Tucson °F.	Melon temp. in top layer: New York N.Y. °F.	Top-ice inspection	Melon and load inspections
16 PFE 32339	40	+ 14	78	40	37	37	Tucson: Load about 2/3 covered. New York: About 300 lbs. Top-ice left, 200 lbs. between crates.	Brawley: Good choice melons. New York: Crates wet, melons mostly yellow green, firm, some ripe, no mold or decay.
17 PFE 96804	34	+ 12	73	44	39	35	Tucson: Load still about 2/3 covered. New York: About 30 lbs. left, 350 lbs. channel ice.	Brawley: Well colored choice melons, New York: About half of top layer crates dry, melons mostly yellow green, firm to ripe, no decay.
13 PFE 42794	28	+ 8	68	40	38	42	Tucson: About 10% of load covered. New York: None left, ab- 50 lbs. on floor.	Brawley: Good maturity. New York: Top crates dry, melons yellow green, firm, no mold or decay.
18 PFE 43418	28	+ 7	70	42	40	37	Tucson: About 20% of load covered. New York: No top-ice left, about 100lbs. channel ice.	Brawley: Well colored choice melons. New York: Top crates dry, melons yellow green, mostly firm, no mold or decay.
14 PFE 60512	35	+ 1	87	44	37	38	Tucson: Ice in patches, load about 40% covered. New York: Practically none left, about 100 lbs. on floor of car.	Brawley: Good maturity. New York: Top crates mostly dry, melons on the green side, mostly firm, no mold or decay.
15 PFE 64786	35	- 2	91	42	40	39	Tucson: Load about $\frac{1}{4}$ covered, New York: No top-ice left, about 100 lbs. channel ice.	Brawley: Melons well colored, firm ripe or choice. New York: top crates mostly dry, melons mostly yellow green, firm to ripe.

Table 6. Comparison of cantaloup cars shipped June 7 to Chicago and New York, under different amounts of top-ice.

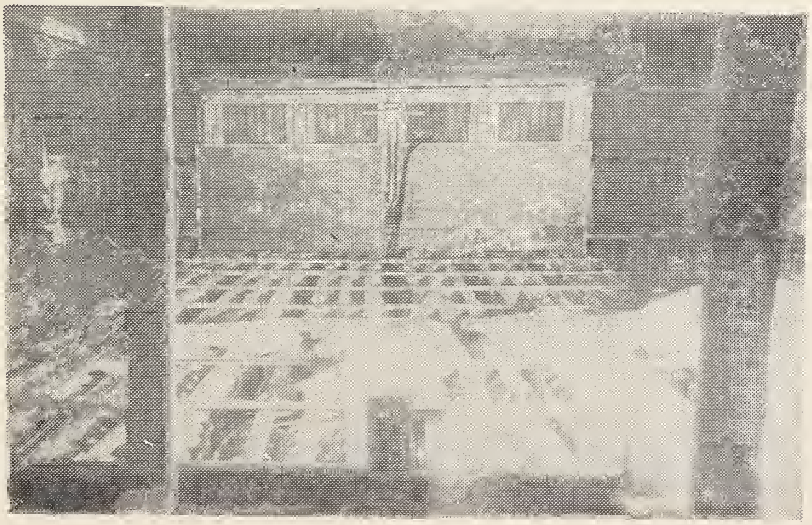
Car	Transit period	Top-ice: 300 lb. blocks	Top-ice: Excess or deficit 300 lb. blocks	Average temp. when loaded	Melon temp. in top layer: Yuma	Melon temp. in top layer: Tucson	Melon temp. in top layer: El Paso	Melon temp. in top layer: Destination	Top-ice inspection.	Melon & load inspections
				°F.	°F.	°F.	°F.	°F.		
E	6/7 to 6/15	15 (Precooled)	-11	78	45	41	41	40	Tucson: None left, all gone at Brawley, melted off by pre-cooling, New York: None left.	Brawley: A ripe car of melons, distinctly yellow, firm ripe, choice. New York: Distinctly yellow, attractive, firm ripe to ripe, no decay, high color.
F (Fan car)	6/7 to 6/15	28	0	81	42	37	37	37	Tucson: Few small patches left. Dalhart: About 100 lbs. on leeward side of breakdown crates.	Brawley: Commercial choice, yellow to greenish yellow, firm ripe maturity. New York: Color yellowish, very uniform, a little less yellow than liked, no decay.
G	6/7 to 6/15	35	+ 2	86	39	36	35	38	Tucson: Load about half covered. Dalhart: Still about 100 lbs. left. New York: Top-ice gone, about 100 lbs. in channels.	Brawley: Commercial choice, yellow, to greenish yellow, variable, some full ripe, crates. New York: No decay, even on ripe melons, generally good color.
H	6/7 to 6/12	12	- 11	74	51	44	42	39	Tucson: None left, all melted off in about 5 hours after top-icing. Chicago: None left.	Brawley: A car of commercial hard ripe, sutures green, not high color, yellow green. Chicago: Melons still not well colored, some green sutures.



Brawley, Calif. When top-iced 3:10 P.M., May 28, with 25 blocks. Fairly even job.

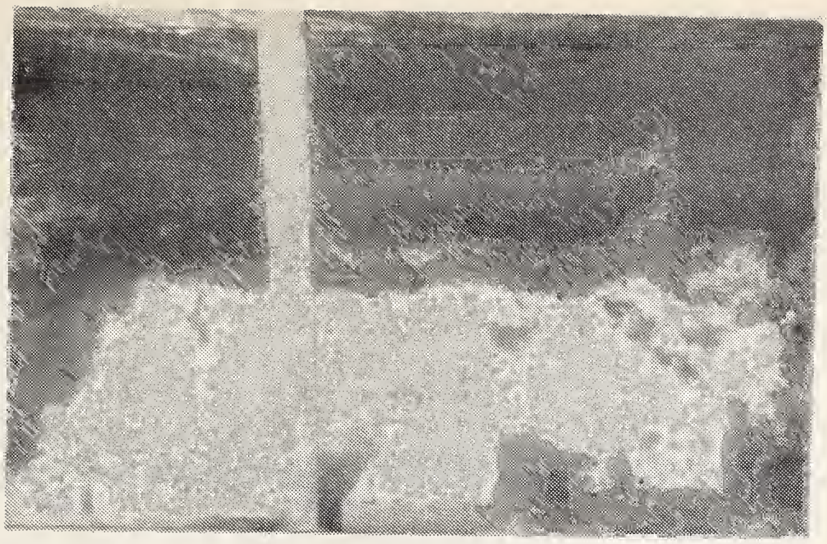


Yuma, Ariz. 11:00 A.M., May 29. 20 hours later most of ice gone.

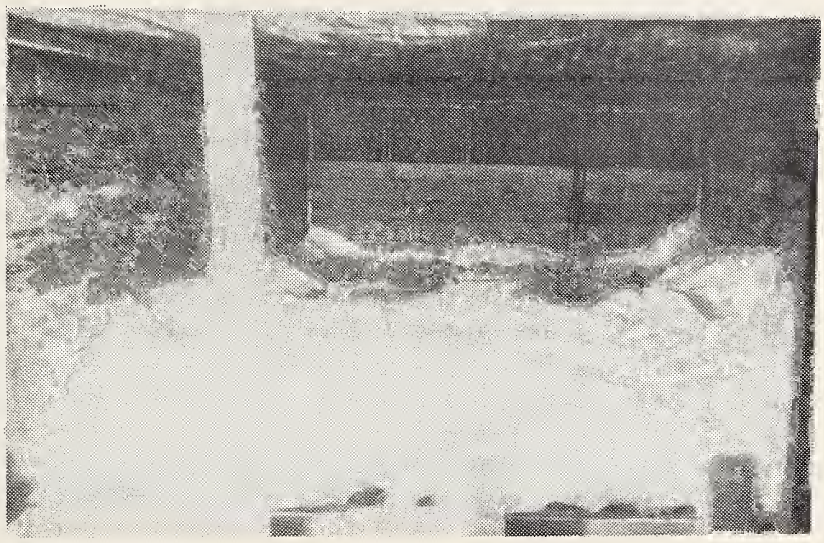


Tucson, Ariz. 12:01 A. M., May 30. 33 hours after top-icing. Little meltage between Yuma and Tucson.

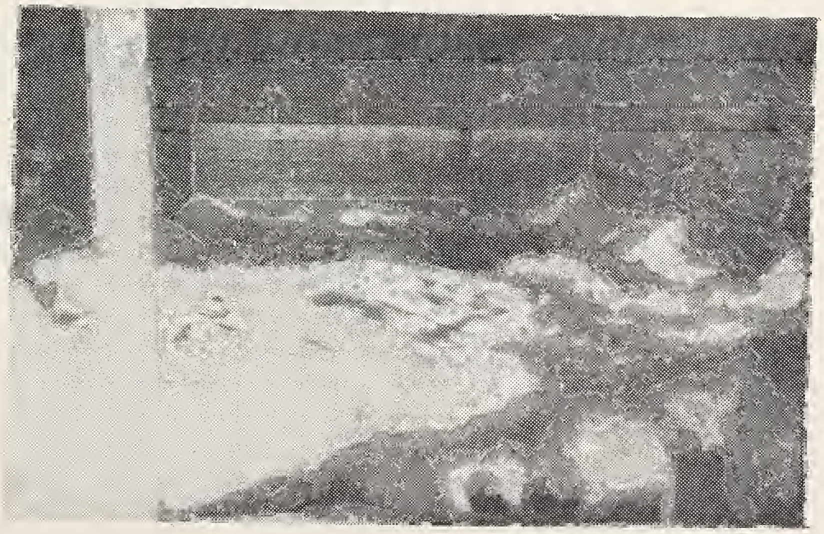
Figure 1. An example of top-icing with 7 blocks less than 86° F. load temperature called for. Car 1.



Brawley, Calif. When top-iced 1:30 P. M., May 28, with 34 blocks. Not evenly distributed.



Yuma, Ariz. 11:00 A.M., May 29, 21½ hours later. More ice left than needed.



Tucson, Ariz. 12:01 A.M., May 30. 34½ hours after top-icing. Little meltage between Yuma and Tucson.

Figure 2. A car top-iced with 7 blocks in excess of schedule (on page 2). Car 5. 80° F. when loaded.

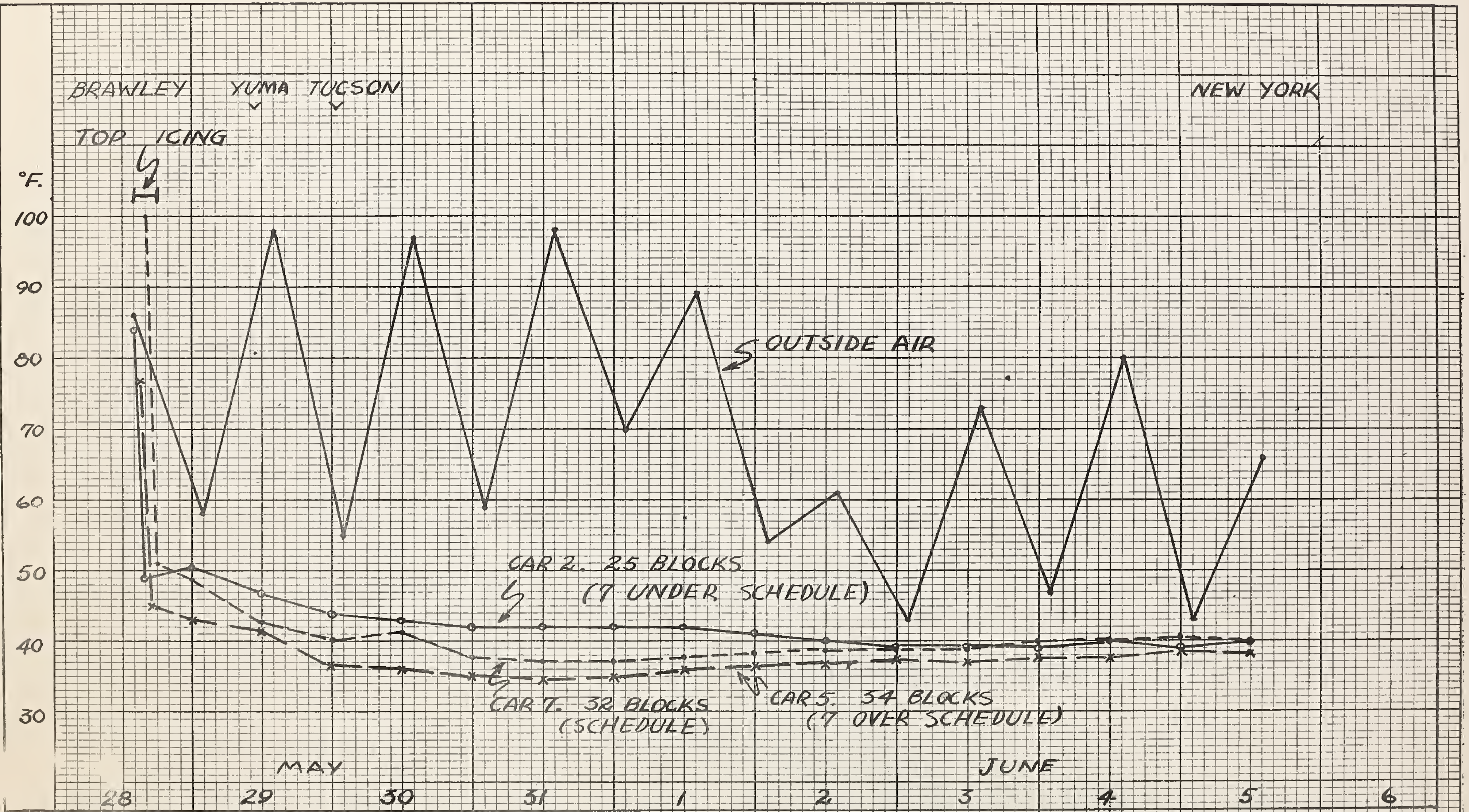


Figure 3. Comparison of top layer temperatures in top-iced cars of cantaloups shipped from Brawley, California, to New York, N. Y., May 28, 1947.

Car 2. 86° F. when loaded, top-iced with 25 blocks, 7 under schedule.
Car 7. 85° F. when loaded, top-iced with 32 blocks according to schedule.
Car 5. 80° F. when loaded, top-iced with 34 blocks, 7 over schedule.

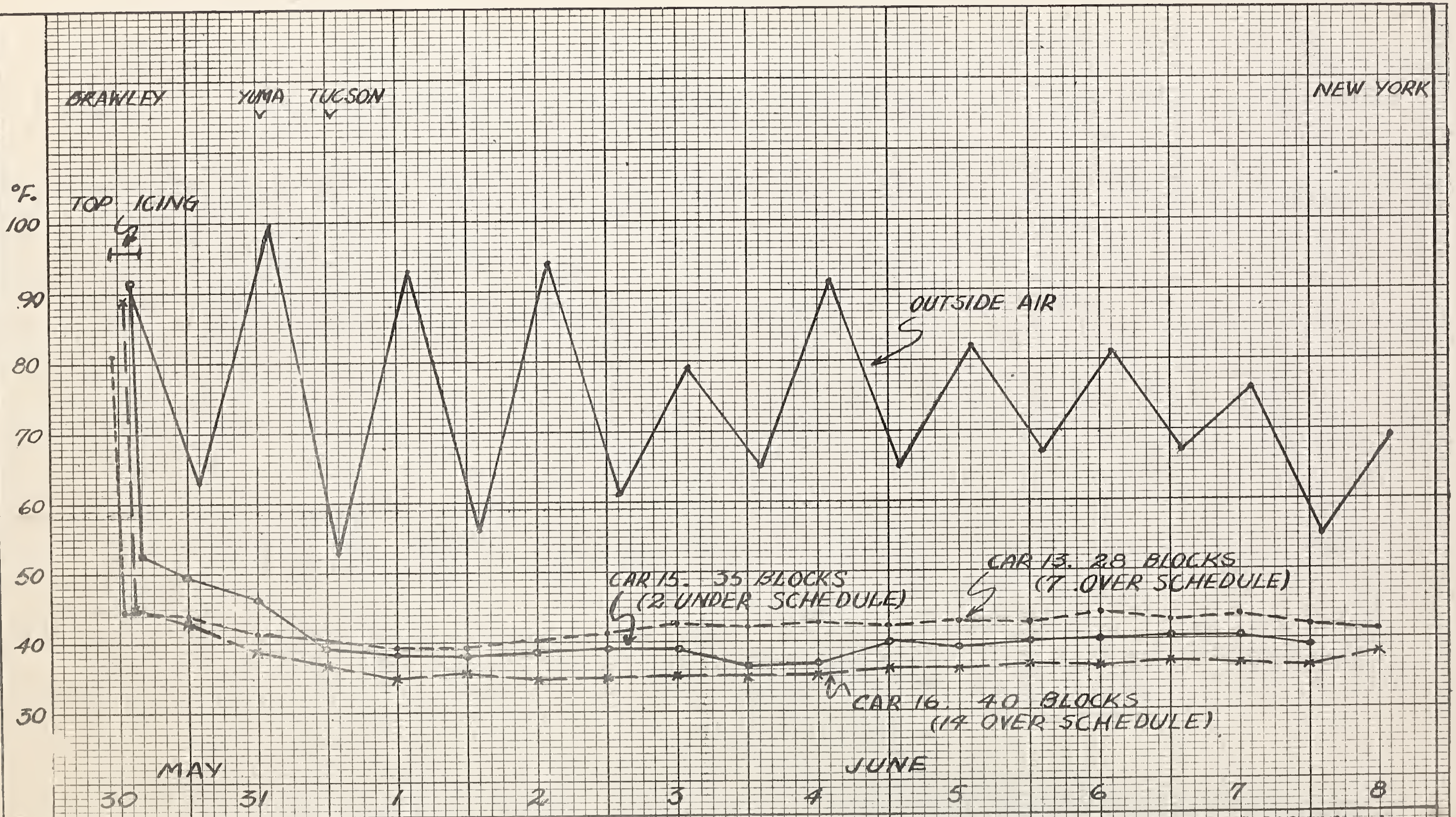


Figure 4. Comparison of top layer temperatures in top-iced cars of cantaloups shipped from Brawley, California, to New York, N. Y., May 30, 1947.

Car 15. 91° F. when loaded, top-iced with 35 blocks, 2 less than schedule.
Car 13. 68° F. when loaded, top-iced with 28 blocks, 7 more than schedule.
Car 16. 78° F. when loaded, top-iced with 40 blocks, 14 more than schedule.

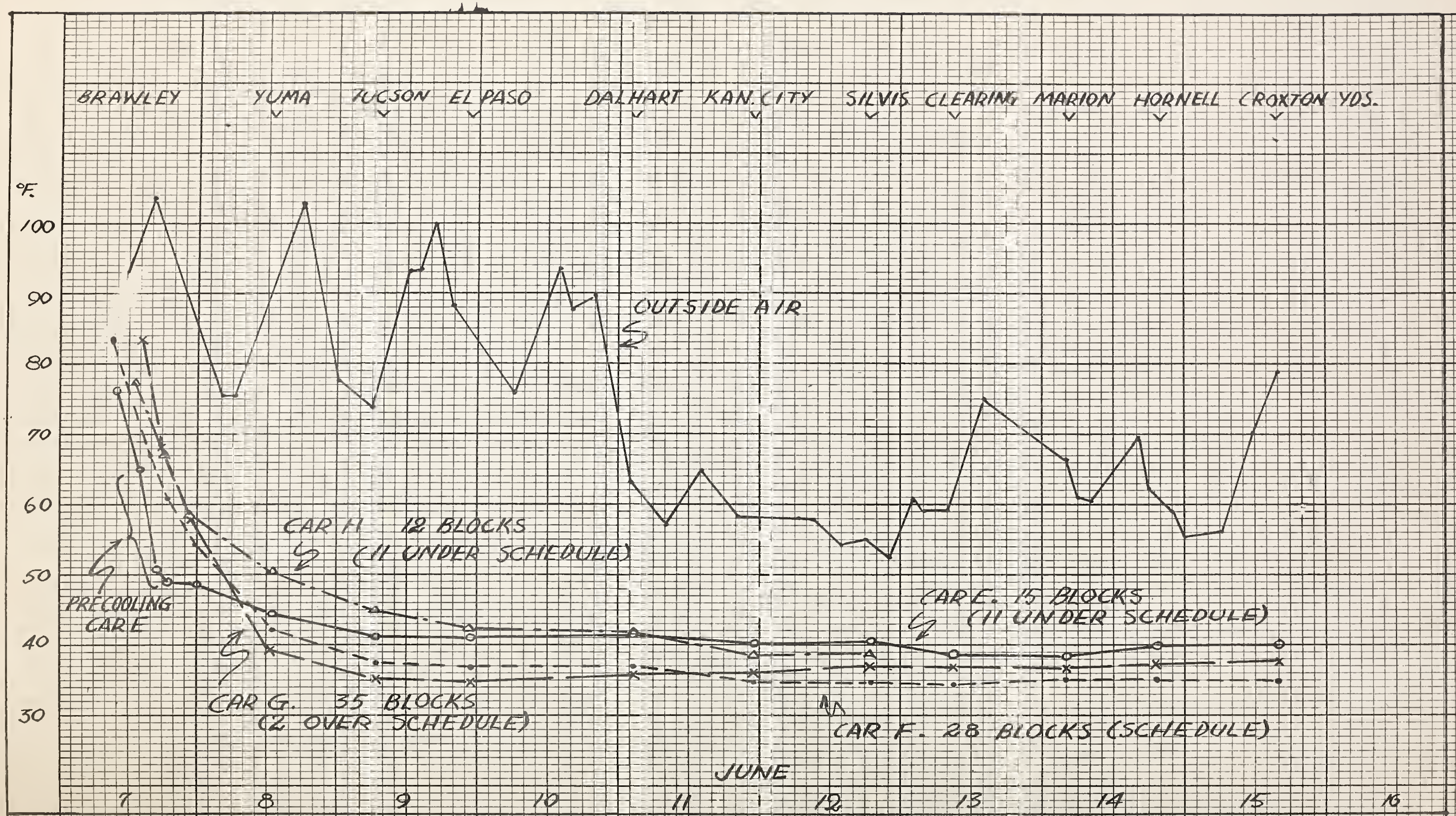


Figure 5. Comparison of top layer temperatures in top-iced cars shipped from Brawley, California, to Chicago and New York, June 7, 1947.

Car E. 78° F. when loaded, top-iced with 15 blocks, 11 under schedule, precooled for 4 hours with track-side unit, first 2 hours of which mechanical refrigeration not use.

Car F. 81° F. when loaded, top-iced with 28 blocks according to schedule, fan car, fans on.

Car G. 86° F. when loaded, top-iced with 35 blocks, 2 over schedule.

Car H. 74° F. when loaded, top-iced with 12 blocks, 11 under schedule.

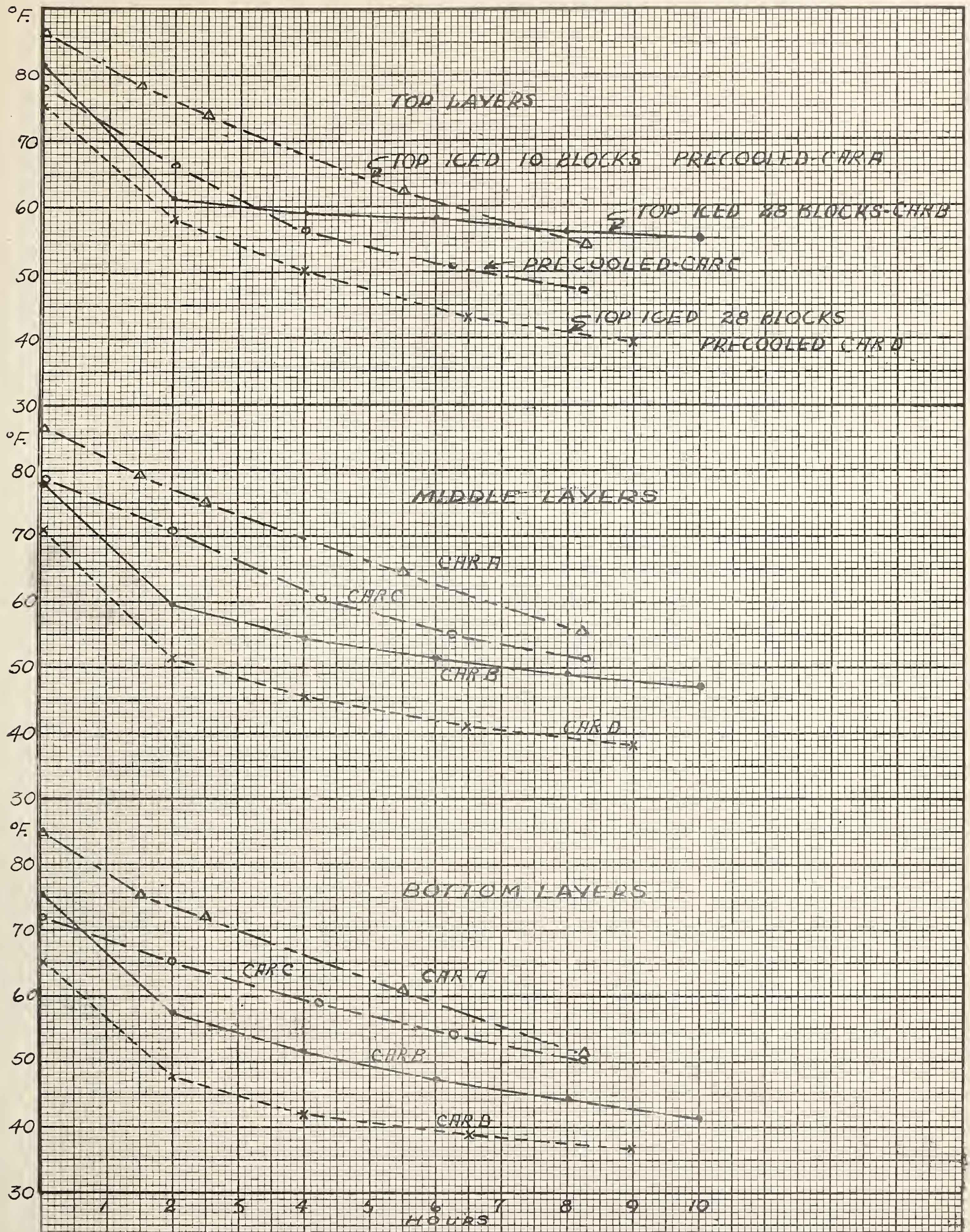


Figure 6. Comparison of cooling rates in cars of cantaloups.
Car A. Top-iced with 3,000 pounds, precooled, Car B. top-iced with 8,400 pounds, Car C. precooled, Car D. top-iced with 8,400 pounds, precooled.